RAID

User Guide

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Product notice

This user guide describes features that are common to most models. Some features may not be available on your computer.

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1 Introduction

Until recently, there were limited options for most computer users who wanted to protect their data from loss in the event of a hard drive failure. These options were manually copying files to a backup drive or using cumbersome backup software. If users failed to perform one of these mundane tasks prior to a hard drive failure, they had to spend considerable time and money to recover even a portion of the data on the drive. Server and desktop computer users have long enjoyed the security and benefits of RAID (Redundant Array of Independent Disks) technology to recover data in the event of drive failure.

HP now offers a simple RAID solution for notebook computer users who need to protect data on a Serial ATA (SATA) disk drive in case of drive failure or virus attacks. HP's RAID solution also benefits computer users who frequently work with large files and want to improve the storage performance of their computer.

NOTE: The illustrations in this guide are provided in English only.

2 RAID technology overview

This chapter defines the terms used in this guide and describes the RAID technologies supported by select HP Business computers.

RAID terminology

Some of the terms in the following table have a broader meaning, but they are defined in relation to the RAID implementation described in this guide.

Term	Definition
Fault tolerance	The ability of the computer to continue to operate if one drive fails. Fault tolerance is often used interchangeably with reliability, but the two terms are different.
HDD	One physical hard disk drive in the RAID array.
Option ROM	A software module inside the system's BIOS that provides extended support for a particular piece of hardware. The RAID option ROM provides boot support for RAID volumes as well as a user interface for managing and configuring the system's RAID volumes.
Primary drive	The main internal HDD in the computer.
RAID array	The physical drives that appear as one logical drive to the operating system.
RAID migration	The change of data from a non-RAID to RAID configuration. “RAID level migration,” or the change of data from one RAID level to another, is not supported.
RAID volume	A fixed amount of space across a RAID array that appears as a single HDD to the operating system.
Recovery drive	The hard drive that is the designated mirror (copy of the primary) drive in a RAID 1 and Recovery volume.
Reliability	The likelihood—over a period of time—that a HDD can be expected to operate without failure, also known as mean time before failure (MTBF).
Stripe	The set of data on a single hard drive in a RAID volume.
Striping	The distribution of data over multiple disk drives to improve read/write performance.

RAID modes supported

The RAID modes supported by HP Business computers include RAID 0, RAID 1, RAID 5, and Flexible data protection (Recovery) as described below. RAID modes 0, 1, and Recovery require two SATA HDDs. RAID mode 5 requires three SATA HDDs. This can be accomplished by inserting a second SATA hard drive into the Upgrade Bay, eSATA port (if available), or the second hard drive bay (if available) of the computer, or into the SATA-swappable bay of the HP Advanced Docking Station (see Devices supported on page 7). RAID 10 is not supported.

RAID 0

RAID 0 stripes, or distributes, data across both drives. This allows data, especially large files, to be read faster because data is read simultaneously from both drives. However, RAID 0 offers no fault tolerance, which means that if one drive fails, the entire array fails.

The usable amount of the drives is the minimum size of the unassigned space x 2 (number of the HDDs). For example, if disk 1 has 150 GB of free space and disk 2 has 600 GB of free space, the usable amount is 150 GB x 2 = 300 GB. It is recommended to use HDDs of the same size and specifications for RAID configuration.

RAID 1

RAID 1 copies, or mirrors, identical data on two HDDs. If one HDD fails, RAID 1 allows data to be recovered from the other HDD.

The usable amount of the drives is the minimum size of the unassigned space. For example, if disk 1 has 150 GB of free space and disk 2 has 600 GB of free space, the usable amount is 150 GB. It is recommended to use HDDs of the same size and specifications for RAID.

RAID 5

RAID 5 distributes data across three HDDs. If one HDD fails, RAID 5 allows data to be recovered from the other two HDDs.

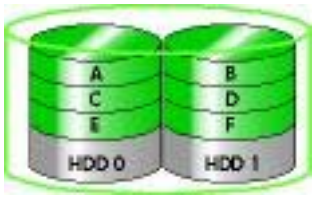
The usable amount of the drives is the minimum size of the unassigned space x 3 (number of the HDDs) x 2/3. For example, if disk 1 has 150 GB of free space, disk 2 has 600 GB of free space, and disk 3 has 400 GB of free space, the usable amount is 300 GB (150 GB x 3 x 2/3). It is recommended to use HDDs of the same size and specifications for RAID.

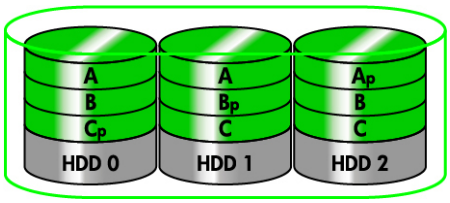
Flexible data protection (Recovery)

Flexible data protection (Recovery) is a feature of Intel® Rapid Storage Technology software. Recovery enhances RAID 1 functionality with several features that make it easier for users to mirror data to a designated recovery drive. For example, Recovery allows users to determine how the recovery volume is updated, either continuously (the default) or on request. Recovery also enables docking and undocking of the computer if the second drive is in the docking station's bay.

RAID mode summary

The following table describes the functions, applications, and advantages and disadvantages of the supported RAID modes.

RAID levels	Function/Applications	Advantages/Disadvantages
RAID 0 	**Function:** **Data is distributed across both disk drives.** Applications: • Image editing • Video production • Pre-press applications	**Advantages:** **Read performance is higher than that of a non-RAID HDD.** **Total storage capacity is doubled.** Disadvantages: The entire array fails if one drive fails; data cannot be recovered. Storage space may be wasted if the capacities of the primary and recovery HDDs are different (see HP SATA drive option kits on page 7).
RAID 1 	**Function:** **Identical (mirrored) data is stored on two drives.** Applications: • Accounting • Payroll • Financial	**Advantages:** **Provides high fault tolerance.** Disadvantages: Only half of the total drive capacity can be used for storage. Storage space may be wasted if the capacities of the primary and recovery HDDs are different (see HP SATA drive option kits on page 7).

RAID levels	Function/Applications	Advantages/Disadvantages
RAID Recovery 	**Function:** **Identical (mirrored) data is stored on two drives.** **Boosts the functionality of RAID 1 with valuable features.** Applications: Any application that requires a simple data protection method.	**Advantages:** **Provides high fault tolerance.** **Users can choose to mirror data continuously or on request.** **Data recovery is quick and easy.** **Allows hot-plugging of mirrored drive (with eSATA or docking station HDD).** **Enables easy migration to non-RAID.** Disadvantages: Only half of the total drive capacity can be used for storage. Storage space may be wasted if the capacities of the primary and recovery HDDs are different.
RAID 5 	**Function:** Distributes data across three HDDs. If one HDD fails, RAID 5 allows data to be recovered from the other two HDDs. Applications: A good choice for large amounts of critical data.	**Advantages:** **Data redundancy** **Improved performance and capacity** **High fault-tolerance and read performance** Disadvantages: During a RAID rebuild after a hard drive fails, system performance can be decreased.

The advantages of RAID modes supported

Fault tolerance and performance are important terms to understand when choosing a RAID mode.

Fault tolerance

Fault tolerance is the ability of a RAID array to withstand and recover from a drive failure. Fault tolerance is provided by redundancy. Therefore, RAID 0 has no fault tolerance because it does not copy data to another HDD. With RAID 1 and Recovery, one drive can fail without causing the array to fail. With Recovery, however, the restoration of a single file or an entire HDD is much simpler than with RAID 1 alone. With RAID 5, one of the three HDDs can fail without causing the array to fail.

Performance

Performance is easy to understand, but it is difficult to measure because it involves several factors, some of which are beyond the scope of this document. Overall storage performance is determined by write performance and read performance, both of which vary based on the RAID technology selected.

- RAID 0 (striping) improves overall storage performance because data can be written and read simultaneously across two HDDs.
- Recovery and RAID 1 (mirroring) writes the same data to both HDDs; therefore, write performance may be slower. However, data can be read from both HDDs, so the read performance can be higher than that of a single non-RAID HDD.
- RAID 5 performs at a level between RAID 0 and RAID 1.

3 Operating systems and devices supported

Operating systems supported

HP RAID supports 32-bit and 64-bit versions of Windows Vista® (SP1 and SP2), and Windows 7 operating systems.

NOTE: HP offers only limited support for Microsoft® Windows® XP Professional (SP1, SP2,and SP3).

Devices supported

This section describes the devices supported for RAID migration, including the SATA drives, computers, and docking station. Device support is summarized in the following table and then explained in more detail below the table. External USB SATA drives connected to the computer or docking station cannot be used for migrating to RAID.

	Primary and Upgrade Bay SATA HDDs in the computer	Primary and secondary bay SATA HDDs in the computer	Docking station HDD or eSATA HDD attached to computer
RAID 0	Yes	Yes	No
RAID 1	Yes	Yes	No
Recovery	Yes	Yes	Yes
RAID 5	Yes	Yes	No

HP SATA drive option kits

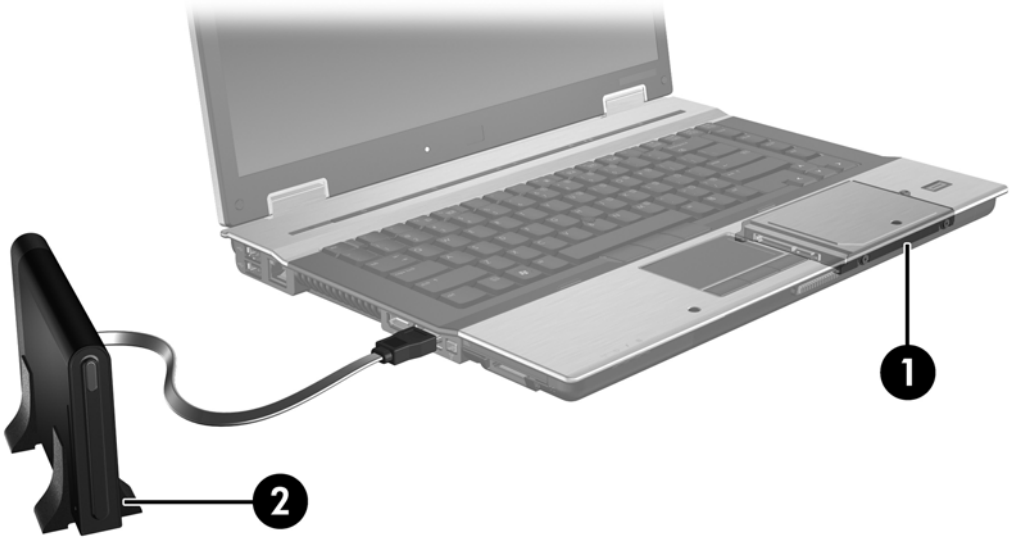
HP offers SATA drive option kits for the computer Upgrade Bay and the docking station's SATA swappable bay to support RAID migration. For optimal RAID performance, it is recommended that both drives have the same speed. However, supported HP Business computers allow drives with different speeds to be used in a RAID volume.

Drives of different capacities are also supported for RAID migration, as long as the capacity of the secondary (recovery) drive is equal to or greater than that of the primary drive. For example, if the primary drive is 200 GB, then at least a 200-GB drive is required in the Upgrade Bay to create a RAID volume. If the capacity of the secondary drive is larger than that of the primary drive, the excess capacity of the secondary (or third) drive will not be accessible. If, for example, the primary drive is 160 GB and the secondary drive is 250 GB, only 160 GB of the secondary drive will be usable in a

RAID configuration. Therefore, for optimal use, it is recommended that both drives have the same capacity.

eSATA HDDs (select models only)

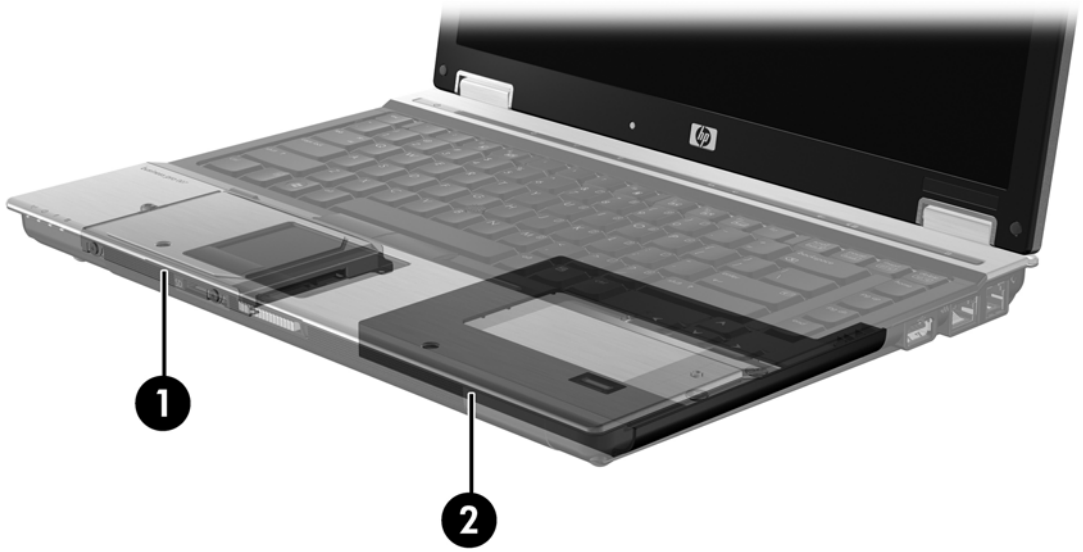
External SATA, or eSATA, is an external interface that allows a SATA drive to achieve data transfer speeds up to 6 times that of a SATA drive using a standard USB 2.0 interface. The following illustration shows a supported computer with a primary HDD **(1)** and an eSATA drive **(2)** connected to the eSATA port (select models only) to allow Recovery. Regarding the capacity of the eSATA drive, the same recommendations apply as stated for secondary drives in the computer Upgrade Bay.



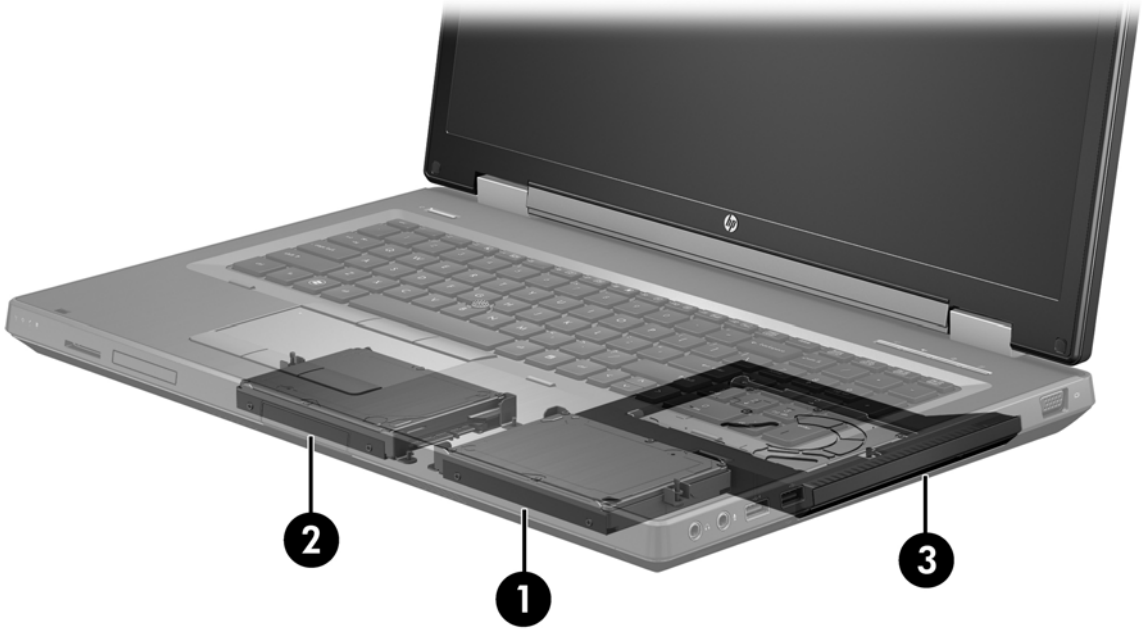
HP Business computers

Select HP Business computers support RAID using Intel® Rapid Storage Technology software (v10 and higher) and a second SATA drive in the Upgrade Bay.

The following illustration shows a supported computer with the primary HDD **(1)** and a secondary HDD drive in the Upgrade Bay **(2)** that allows RAID 0, RAID 1, and Recovery.



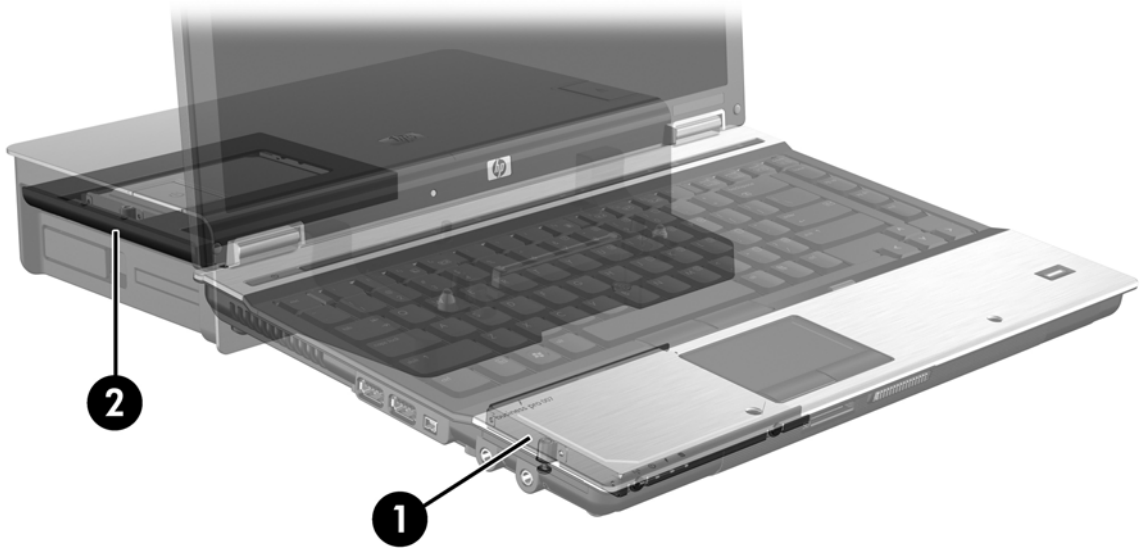
The following illustration shows a supported computer with the primary HDD **(1)** and secondary HDD **(2)**, with the third drive in the Upgrade Bay **(3)** that allows RAID 5.



HP Advanced Docking Station

Recovery supports docking and undocking. It can be used to implement mirroring between the primary HDD **(1)** and an optional HDD in the SATA-swappable bay of the HP Advanced Docking station **(2)**.

The following illustration shows an HP Advanced Docking Station with the recovery HDD in the SATA-swappable bay that allows Recovery.



4 Intel Rapid Storage Technology features

Intel Rapid Storage Technology supports the following Recovery features.

Advanced Host Controller Interface

The Advanced Host Controller Interface (AHCI) is a specification that allows the storage driver to enable advanced SATA features such as Native Command Queuing and hot plug capability. AHCI must be enabled in the system BIOS for these features to apply (see Enable RAID through the system BIOS (f10) on page 13). AHCI is enabled by default on supported HP Business computers.

Native Command Queuing

A read/write drive head writes data to an HDD platter in concentric circles (tracks) based on the order in which the write request was received. Because applications rarely request data in the same order that it was written to the platter, long delays (latency) would result if the drive head had to locate data in the exact order that the HDD receives read requests. Native Command Queuing (NCQ) allows SATA HDDs to accept multiple commands and change their execution order to improve performance. This is analogous to the way an elevator reorders floor requests to minimize travel time and mechanical wear. Similarly, NCQ reduces the latency and unnecessary drive head movement required to execute multiple outstanding read/write requests, resulting in increased performance and reliability. NCQ requires support from the system BIOS, SATA controller, and controller driver.

Hot plug capability

Hot plug capability allows the SATA recovery HDD to be removed or inserted while the computer is running. Hot plug capability is supported when the recovery HDD is connected to the eSATA port or located in the docking station's SATA-swappable bay. For example, the recovery HDD in the docking station's SATA-swappable bay can be removed while the computer is running if you need to temporarily insert an optical drive in the bay. Hot plug capability also allows you to dock and undock the computer at any time.

Intel Rapid Recover Technology

Intel Rapid Storage Technology supports the following Recovery features.

Mirror update policies

With Recovery, you can determine how often the mirror HDD is updated: continuously or on-request. When using the continuous update policy, data on the primary drive is simultaneously copied to the mirror drive as long as both drives are connected to the system. If you undock the computer while using the docking station's recovery drive, all new or revised data on the primary HDD is automatically copied to the recovery HDD when the notebook is redocked. This policy also allows for an unfinished mirroring operation to be completed if it was interrupted when you undocked the notebook.

When using the update on-request policy, data on the primary HDD is copied to the mirror HDD only when you request it by selecting **Update Recovery Volume** in Recovery. After the request, only the new or updated files on the primary drive are copied to the mirror HDD. Prior to updating the mirror HDD, the on-request policy allows a file to be recovered if the corresponding file on the primary HDD is corrupted. The on-request policy can also protect data on the mirror HDD if the primary HDD is attacked by a virus, provided you do not update the mirror HDD after the virus attack.

NOTE: You can change the mirror update policy at any time by right-clicking **Modify Volume Update Policy**.

Automatic HDD switching and rapid recovery

If the primary HDD fails, Recovery automatically switches to the mirrored drive without user intervention. Recovery displays a message to notify you of the primary HDD failure. In the meantime, the computer can boot from the mirrored HDD. When a new primary HDD is installed and the computer is booted, Recovery's rapid recovery feature copies all mirrored data to the primary HDD.

NOTE: If using the update on request policy and the primary HDD fails or a file on the primary HDD becomes corrupted, all unmirrored data is lost.

Simplified migration from RAID to non-RAID

Users can migrate from a RAID 1 or Recovery volume to two non-RAID HDDs, called "breaking the array," by following the instructions in Resetting RAID drives to non-RAID on page 37.

Migration from RAID 1 to Recovery is also supported. However, migration from RAID 0 to RAID 1 or from RAID 0 to a non-RAID primary HDD is not supported.

5 RAID volume setup

The following instructions assume that a supported HDD is installed in the computer Upgrade Bay, in the SATA-swappable bay of the docking station, or connected to the eSATA port of the computer (see Devices supported on page 7).

The basic RAID migration steps are as follows:

- Enable RAID through the system BIOS.
- Initiate RAID migration using Intel® Rapid Storage Technology Console.

⚠ **CAUTION:** Make sure that the computer is connected to AC power before initiating the following procedures. The loss of power during RAID migration can result in the loss of data.

Enable RAID through the system BIOS (f10)

NOTE: The following procedures assume that you are using the HDD image that shipped with your computer. If a different image is installed on your computer, you must *first* enable RAID through the system BIOS (f10), and then install the operating system and all required drivers, including the Intel Rapid Storage Technology driver. Next, follow the steps in Initiate RAID migration using Intel Rapid Storage Technology Console on page 15.

Users must enable RAID capability through the system BIOS to switch the SATA host controller for RAID. The steps are as follows:

1. Turn on the computer, or restart it.
2. Press f10 as soon as the computer boots.

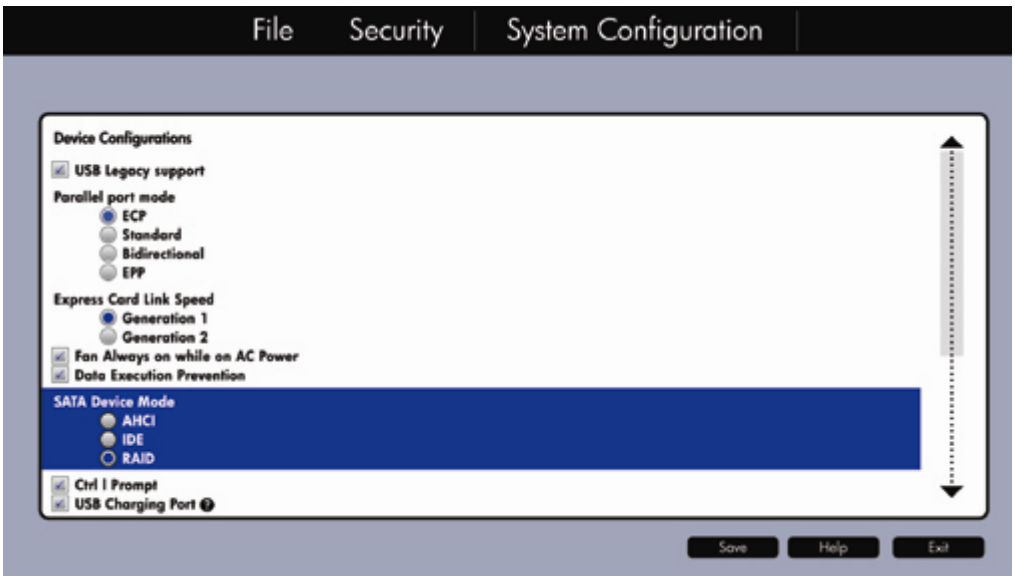
   NOTE: If you do not press f10 at the appropriate time, you must restart the computer, and then press f10 again to access the utility.

3. In the system BIOS, select **System Configuration > Device Configurations**.

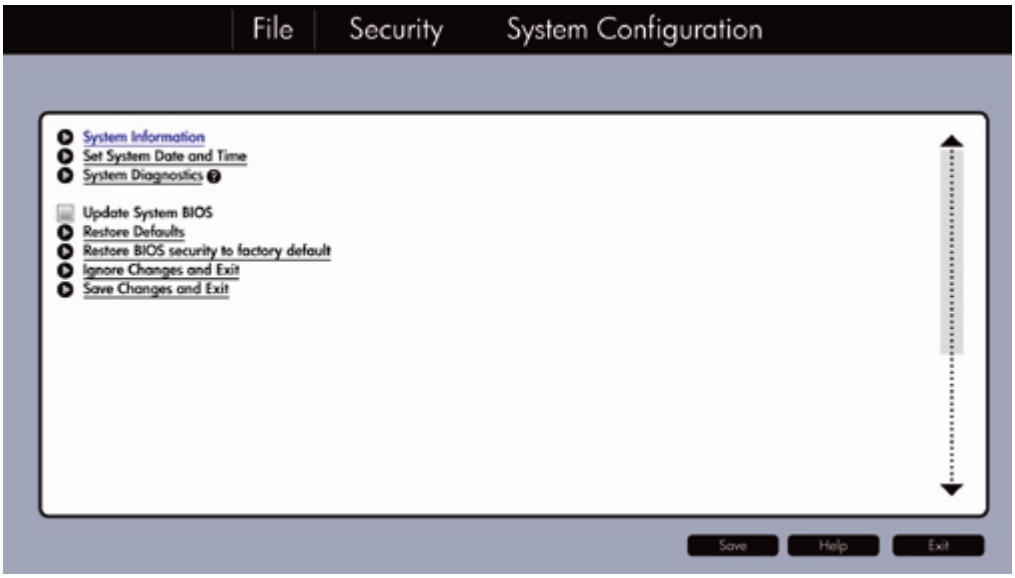
4. In the Device Configurations window, select **RAID** under **SATA Device Mode**. Click **Confirm**. The following message is displayed: “Changing this setting may require reinstallation of your operating system. Are you sure you want to proceed?”

NOTE: The HDD image supplied with your computer contains drivers that allow you to switch between AHCI and RAID modes without reinstalling the operating system. If you use a different HDD image, you may need to reinstall the operating system.

NOTE: Below SATA Device Mode, there is a check box for Ctrl I Prompt. If this is selected, the Intel option ROM screen is visible during the computer bootup time.



5. Select **File > Save Changes and Exit**. Then, click **Yes** to save the changes. If you do not want to apply your changes, select **Ignore Changes and Exit**.



CAUTION: Do NOT turn the computer power off while the ROM is saving the f10 Computer Setup changes, because the Complementary Metal Oxide Semiconductor (CMOS) could become corrupted. Turn the computer off only after exiting the f10 Setup screen.

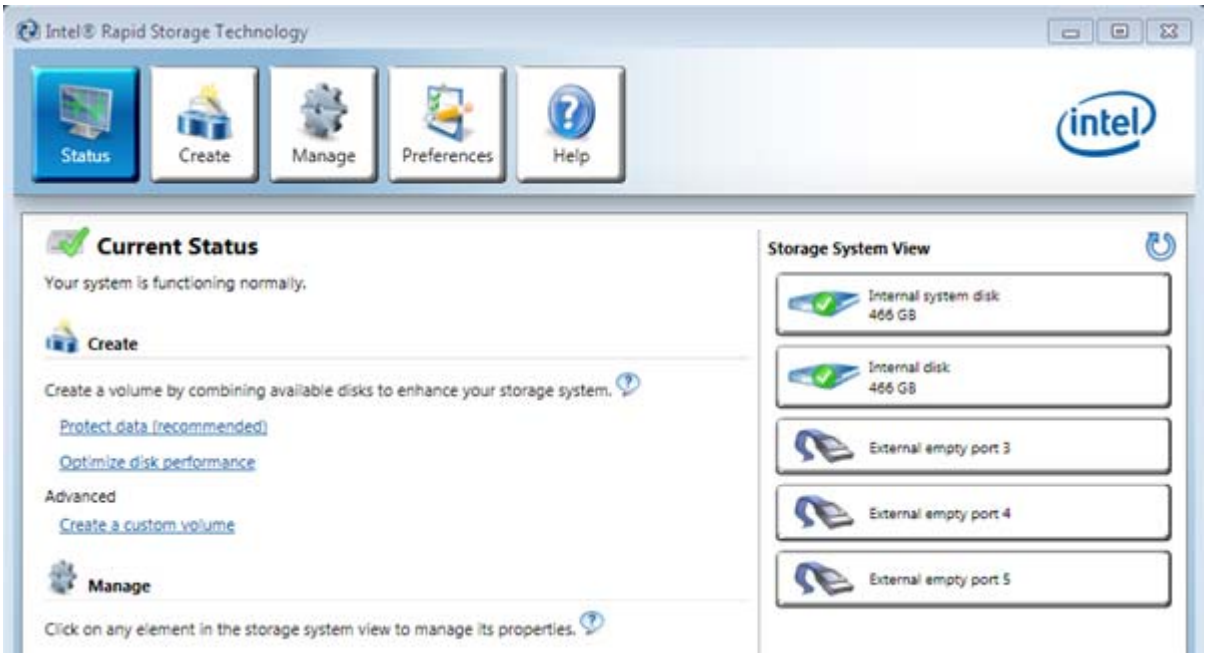
6. After the operating system boots, you can begin the RAID migration procedure.

Initiate RAID migration using Intel Rapid Storage Technology Console

- Open the Intel Rapid Storage Technology Console by selecting **Start > All Programs > Intel Rapid Storage Technology**.

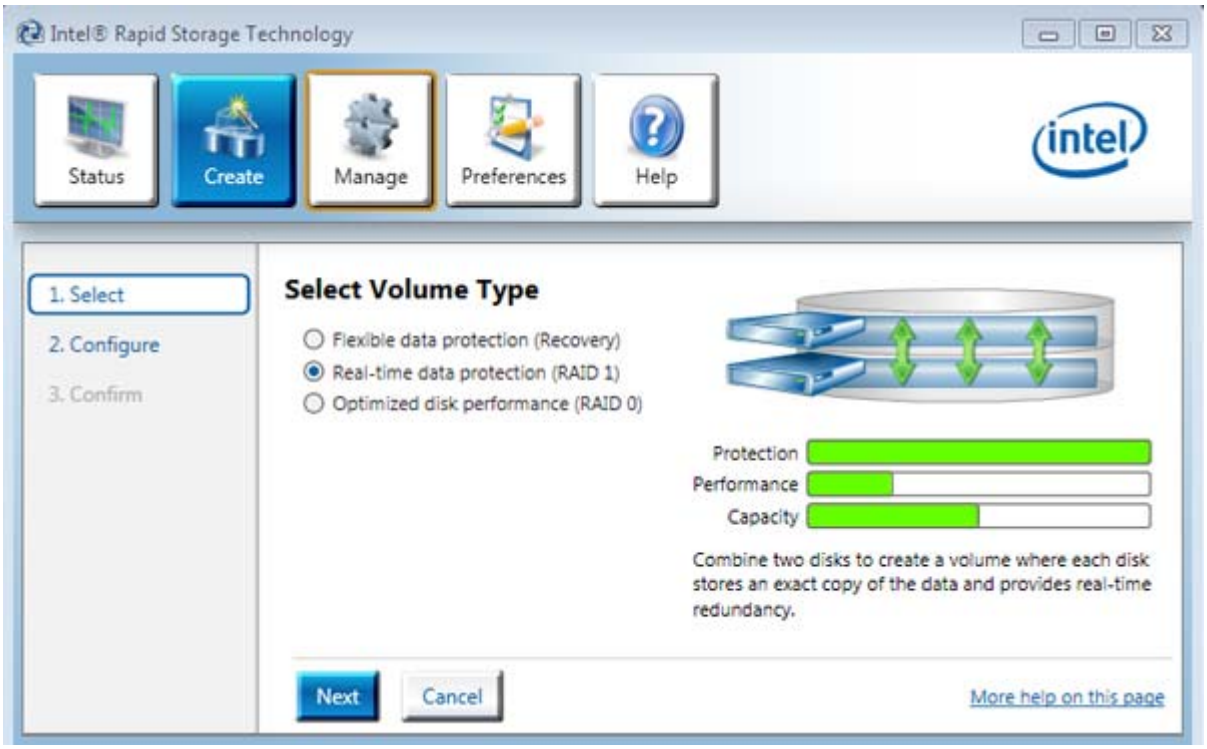
NOTE: Windows Vista and Windows 7 include the User Account Control feature to improve the security of your computer. You may be prompted for your permission or a password for tasks such as installing software, running utilities, or changing Windows settings. Refer to Help and Support for more information.

The console starts at the Status screen, and displays the current status and the hard drives in the system.

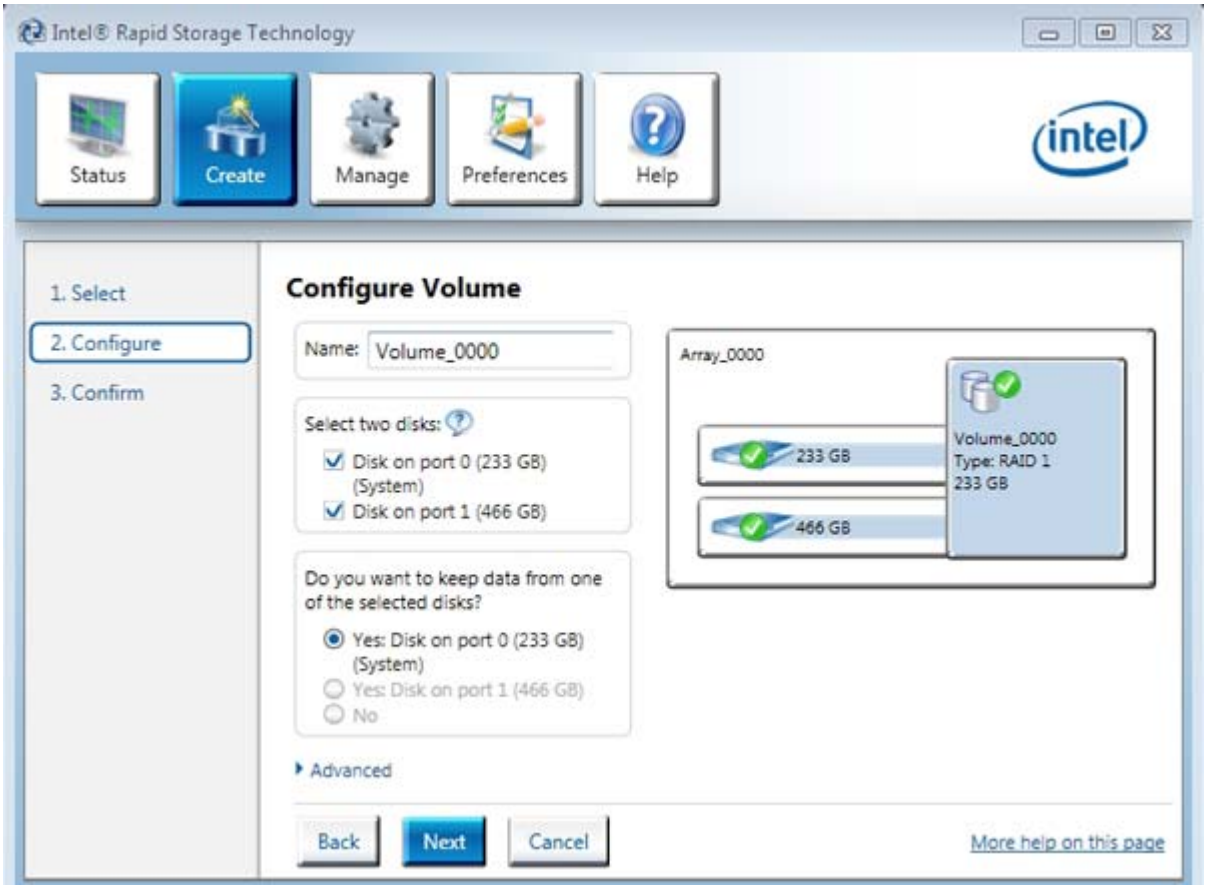


Migrating to RAID 1

1. Click **Create**, click **Real-time data protection (RAID 1)**, and then click **Next**.

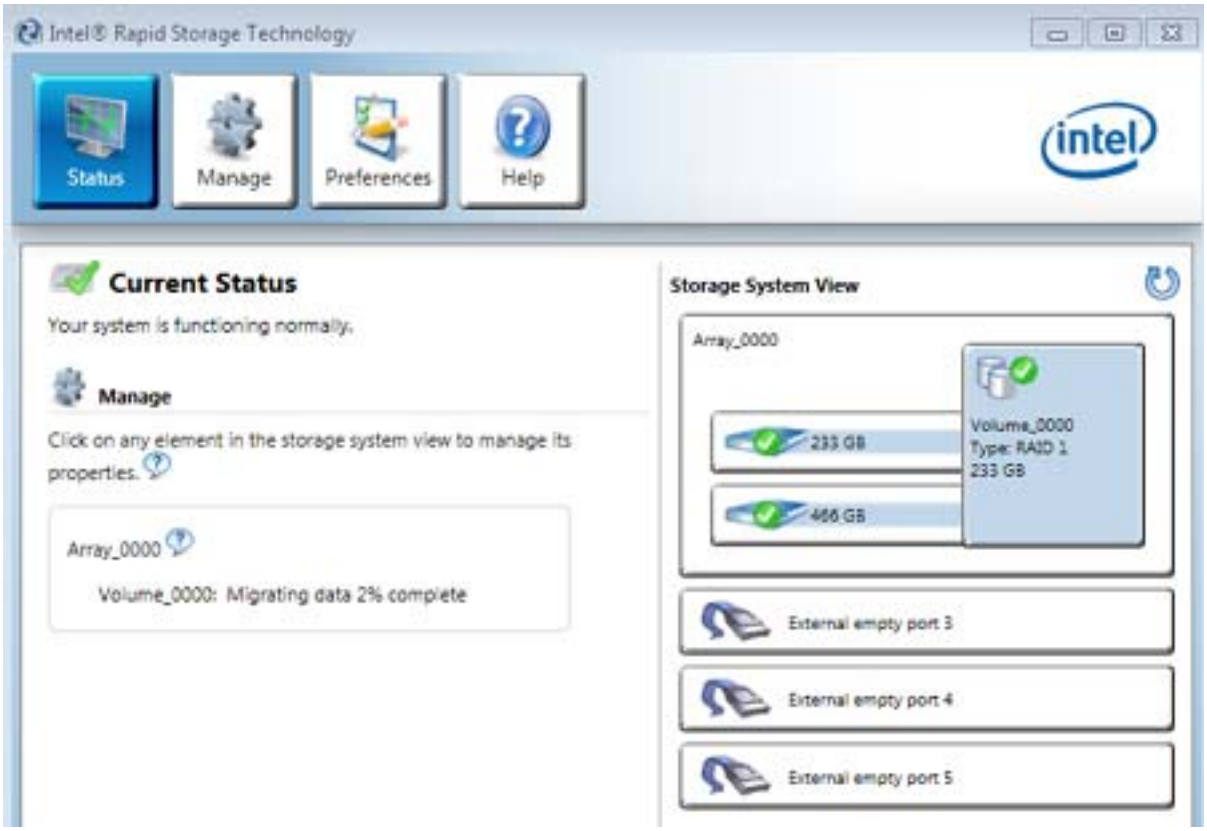


2. Create a volume name (or use the suggested name), select the two HDDs to use for the RAID 1 array, and then click **Next**.



3. Click **Create Volume** to begin the migration process.

4. Once the **Create Volume** button is clicked, you are informed that the array has been created. Click the **OK** button. The array migration continues to run in the background. The computer can be used normally while the migration continues.



5. When you are notified that the array migration is complete, close all open programs and reboot the computer.

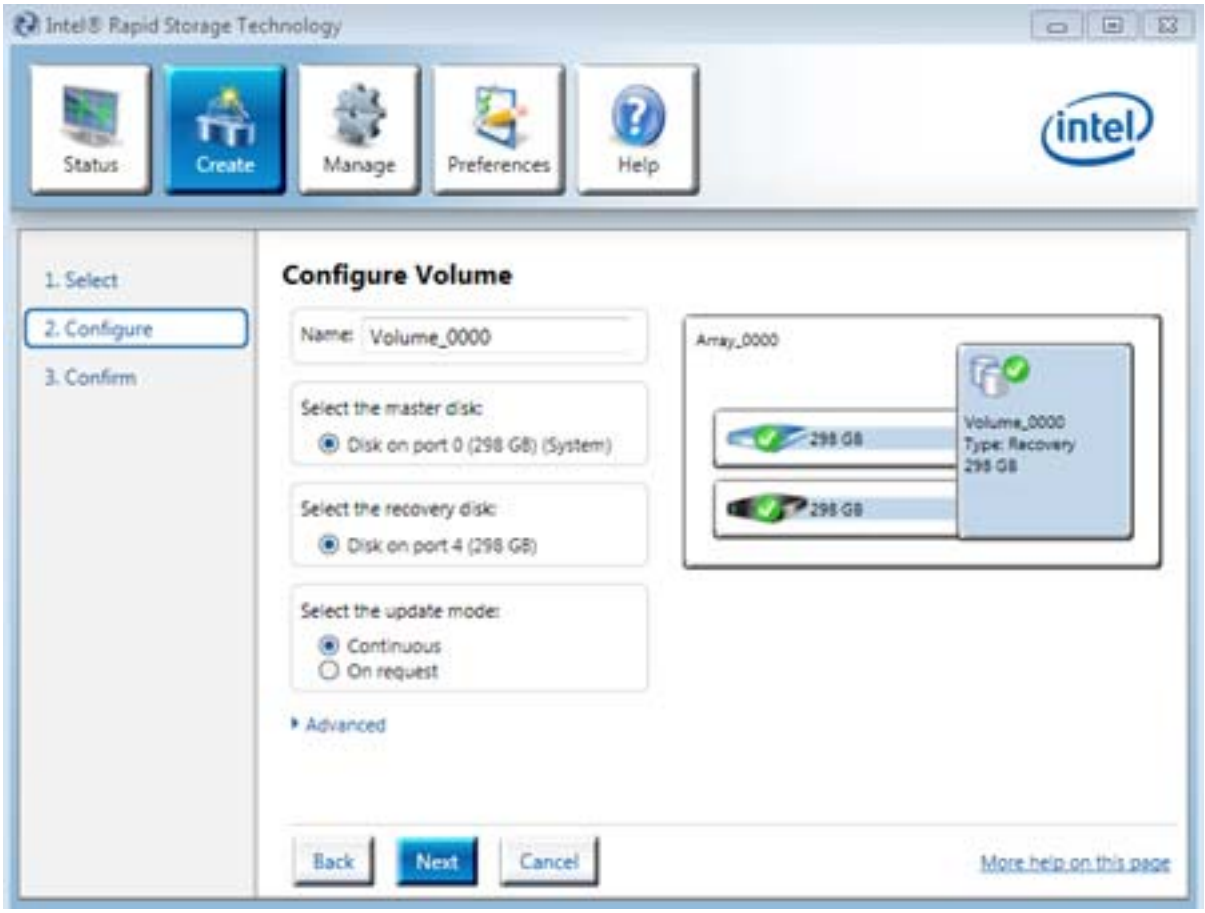
6. When the computer boots up, the operating system detects the newly-created array and requests a reboot. Reboot the computer when prompted. After the final reboot, the RAID migration is complete.

Migrating to Recovery

Recovery offers more control over how data is copied from the primary drive to the recovery drive. When the secondary HDD is in the SATA-swappable bay of the HP Advanced Docking Station or connected to the eSATA port of the computer (select models only), Recovery is the only RAID option available.

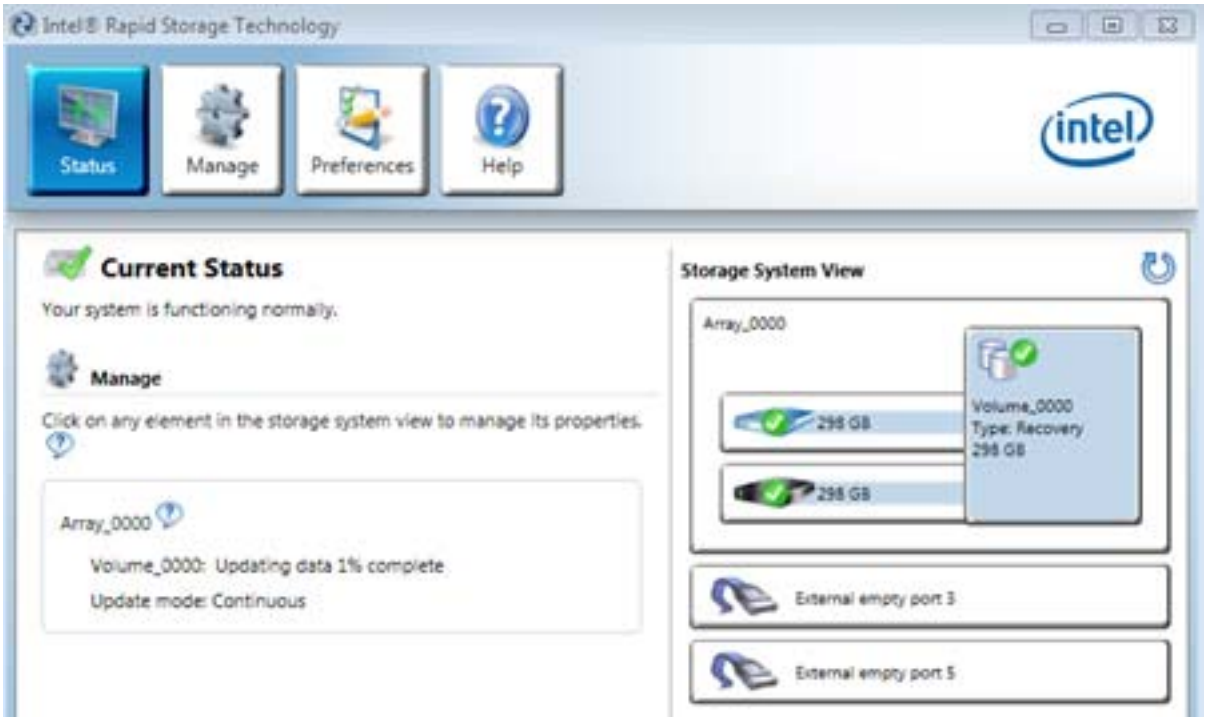
1. Click **Create**, click **Flexible data protection (Recovery)**, and then click **Next**.

2. Create a volume name (or use the suggested name). The two HDDs to use for the Recovery array are already selected. Click **Next**.



3. Click **Create Volume** to begin the migration process.

4. Once the **Create Volume** button is clicked, you are informed that the array has been created. Click the **OK** button. The array migration continues to run in the background. The computer can be used normally while the migration continues.

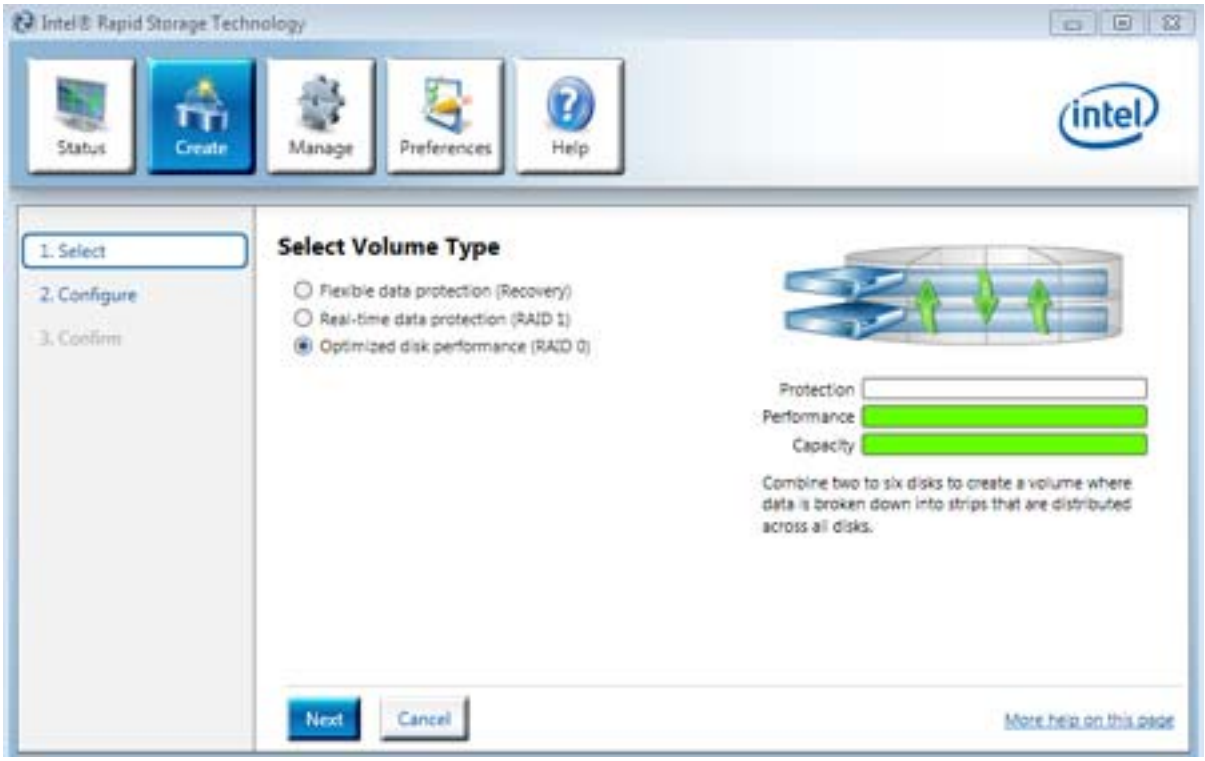


5. When you are notified that the array migration has completed, close all open programs and reboot the computer. When the computer reboots, the operating system detects the newly-created array and requests another reboot. Reboot the computer when prompted. After the final reboot, the RAID migration is complete.

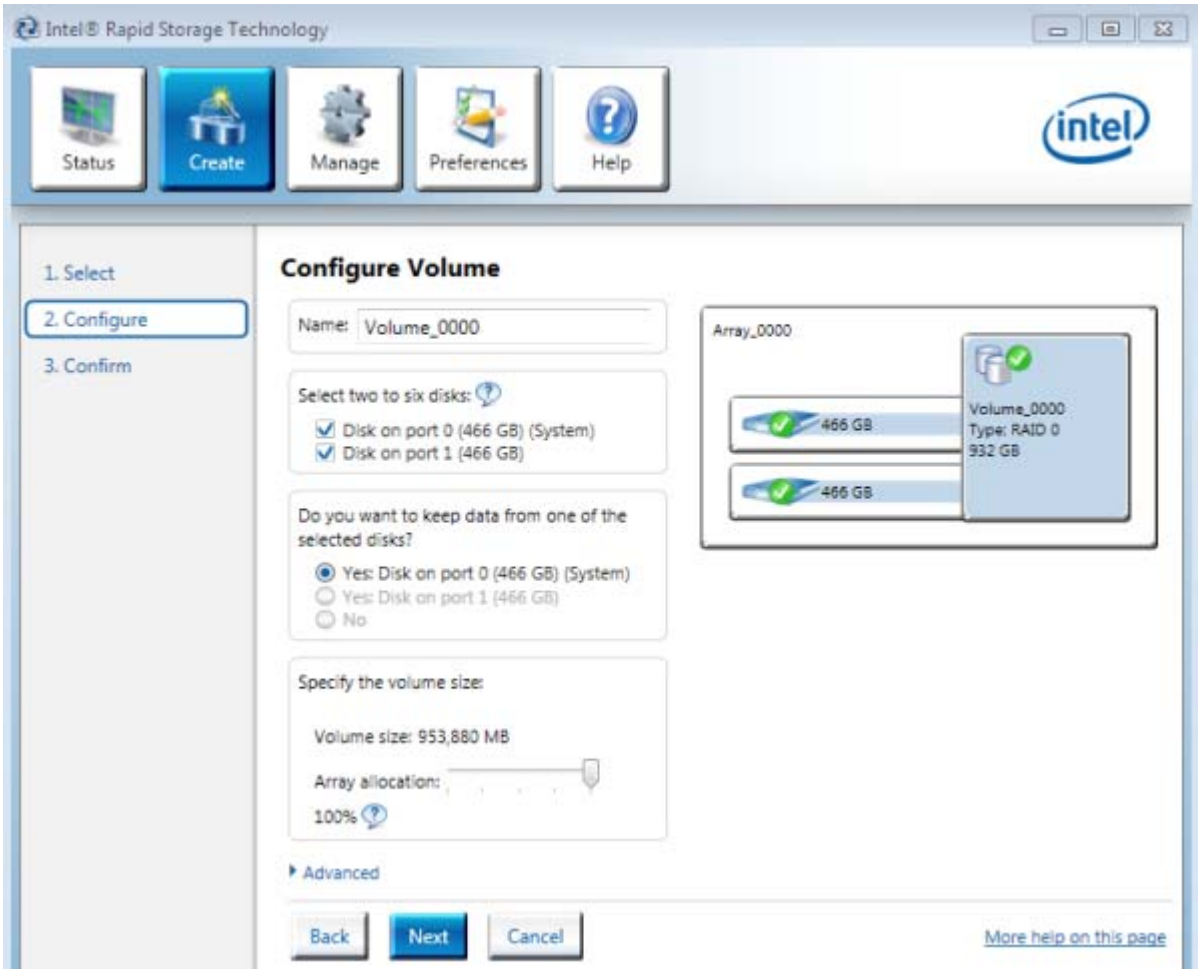
Migrating to RAID 0

NOTE: When using an HP supplied image, migrating to RAID 0 requires you to perform additional advanced steps, including copying data to an additional external USB HDD. Please read the entire RAID 0 migration procedure before you begin.

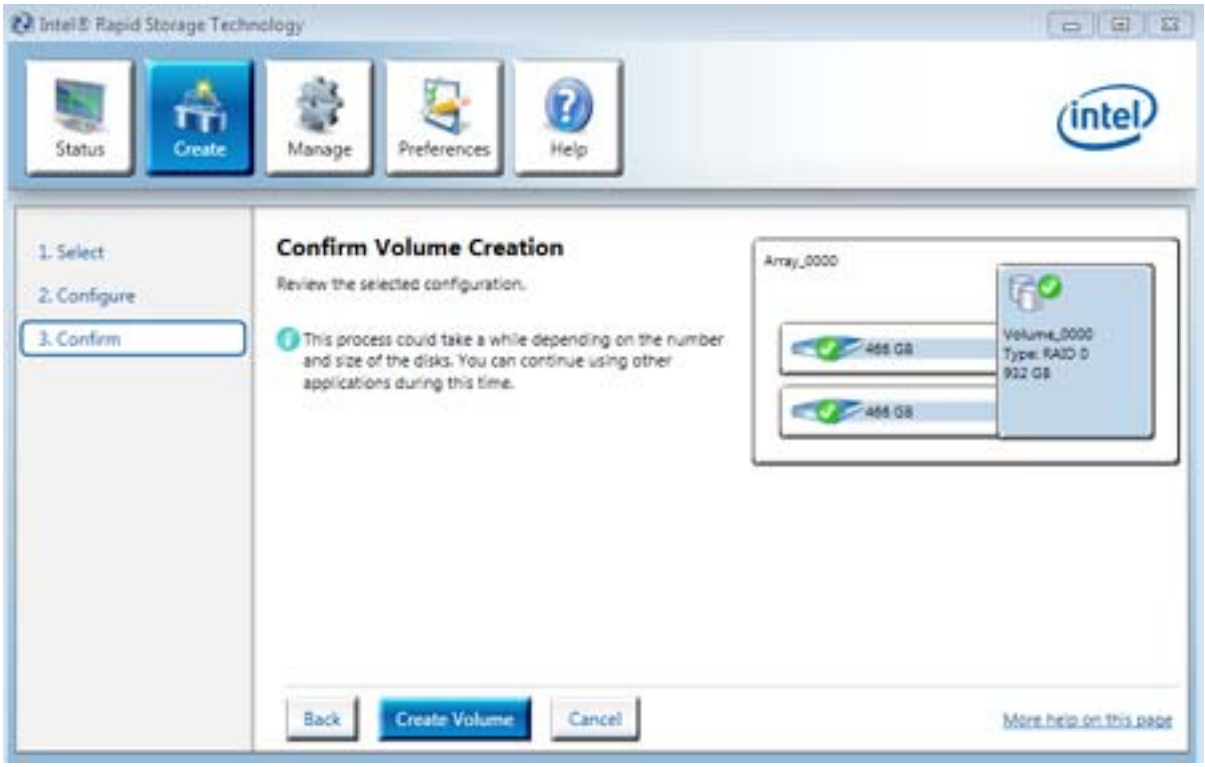
1. Click **Create**, click **Optimized disk performance**, and then click **Next**.



2. Create a volume name (or use the suggested name), select the two hard disk drives to use for the RAID 0 array, and then click **Next**.

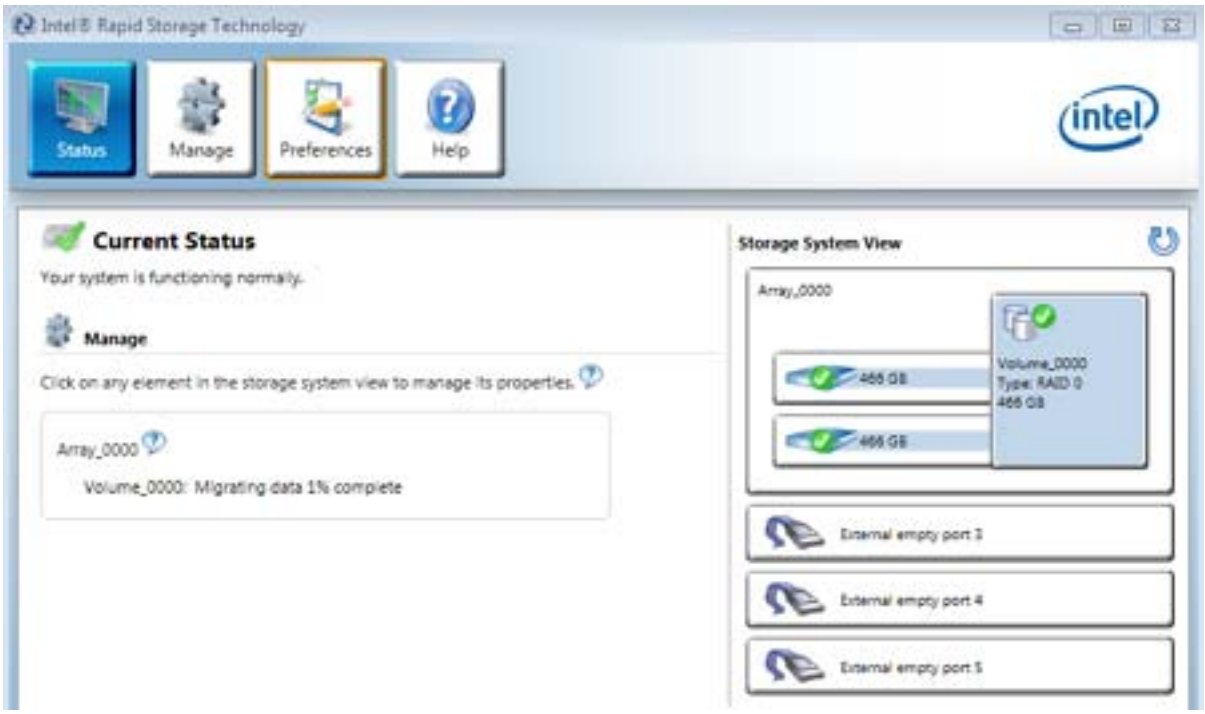


3. Click **Create Volume** to begin the migration process.



4. A message displays, notifying you that the array has been created. Click the **OK** button.

NOTE: The array migration continues to run in the background. The computer can be used normally while the migration continues.



5. When you are notified that the array migration has completed, close all open programs and restart the computer. When the computer is restarted, the operating system detects the newly-created array and prompts you to restart the computer a second time.

6. After you have restarted the computer a second time, the RAID migration is complete.

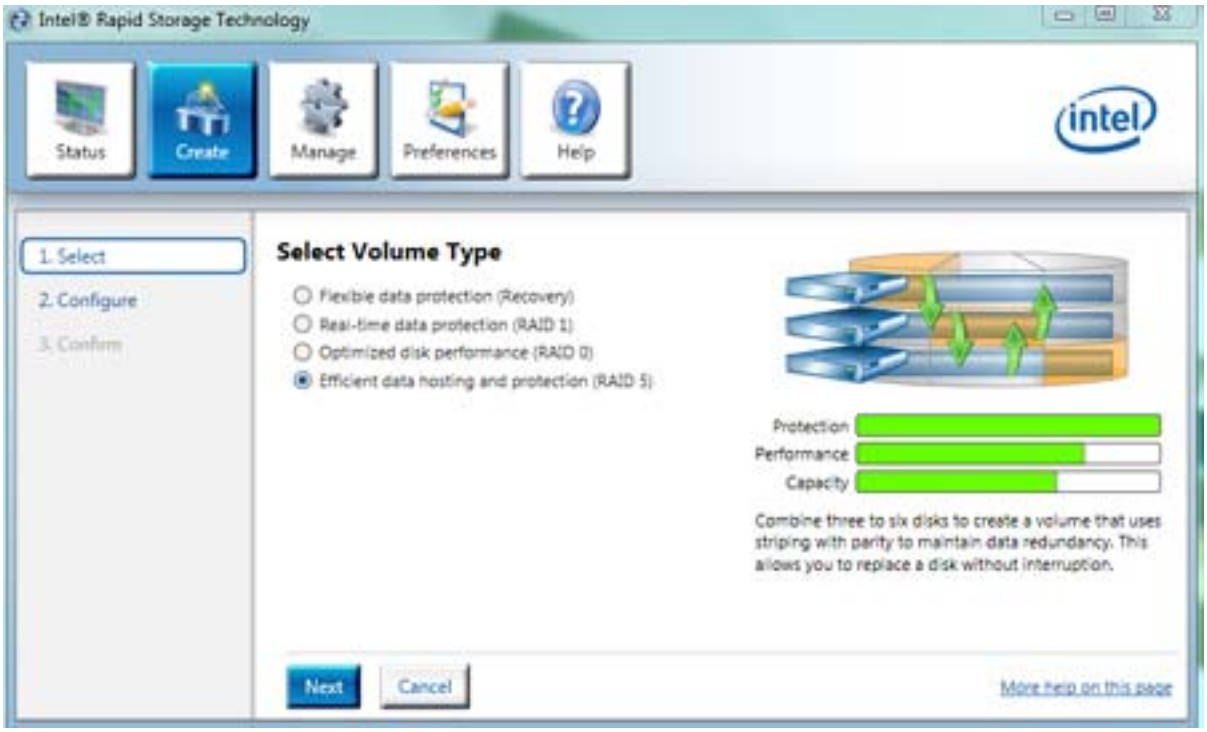
NOTE: Although the total capacity of the RAID 0 volume appears in the Console, the extra capacity created with the addition of the secondary HDD appears to the system as unallocated space. After the system reboots, you must allocate the unallocated space. For Windows XP, the only option through the operating system is to create and format a separate volume. Windows Vista and Windows 7 contain additional capabilities that allow you to create a single RAID 0 volume. Refer to Allocating unallocated HDD space for an HP image on page 30 for further instructions.

Migrating to RAID 5 (select models only)

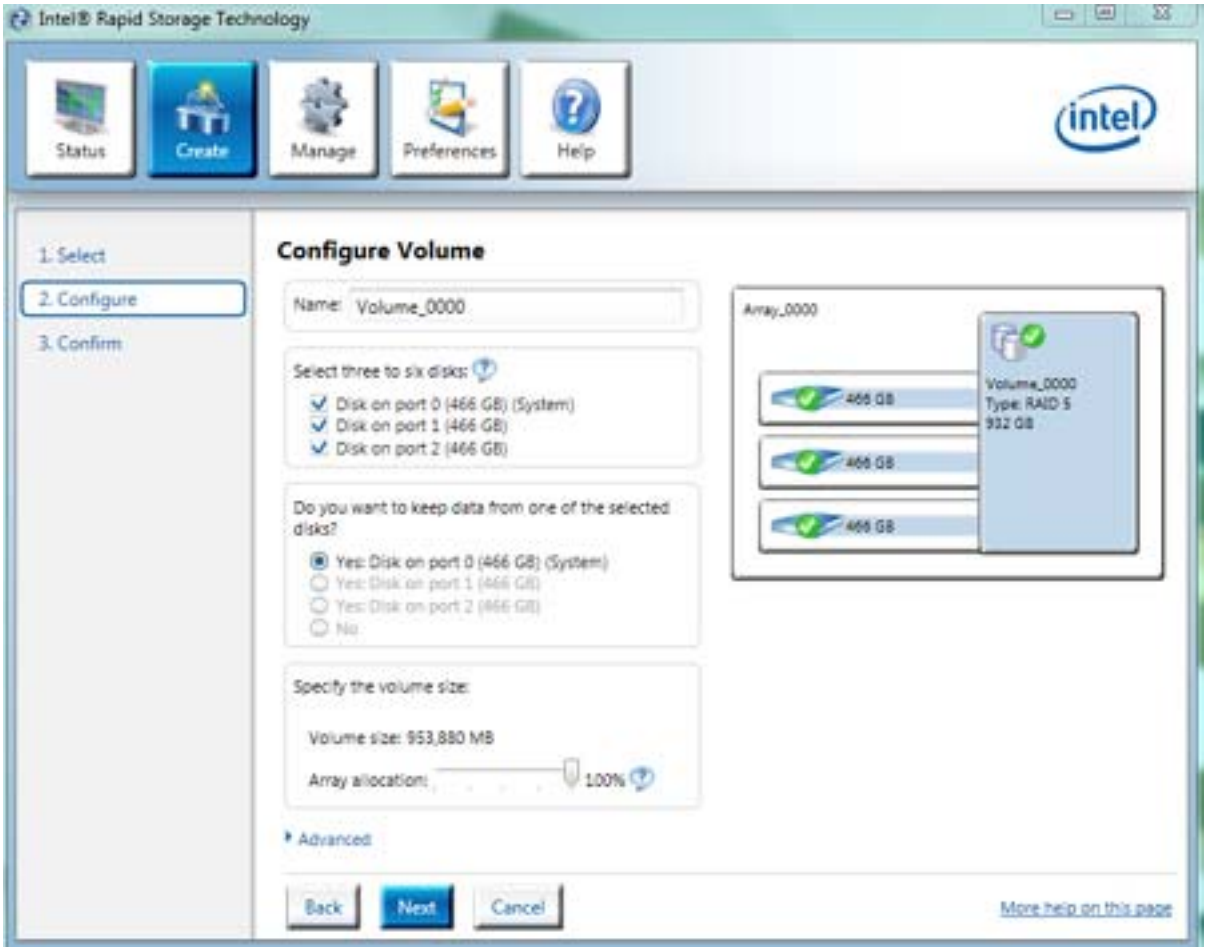
NOTE: When using an HP supplied image, migrating to RAID 5 requires you to perform additional steps, including copying data to an additional external USB HDD. Please read the entire RAID 5 migration procedure before you begin.

NOTE: RAID 5 requires 3 hard drives in the computer: the primary HDD, the secondary HDD, and the upgrade bay HDD.

1. Click **Create**, select **Efficient data hosting and protection (RAID 5)**, and then click **Next**.



2. Create a volume name (or use the suggested name), select the three HDDs to use for the RAID 5 array, and then click **Next**.



3. Click **Create Volume** to begin the migration process.

4. Once **Create Volume** is selected, you are informed that the array has been created. Click the **OK** button. The array migration continues to run in the background. The computer can be used normally while the migration continues.

5. When you are notified that the array migration has completed, close all open programs and restart the computer. When the computer is restarted, the operating system detects the newly-created array and prompts you to restart the computer a second time.

6. After you have restarted the computer a second time, the RAID migration is complete.

NOTE: Although the total capacity of the RAID 5 volume appears in the Console, the extra capacity created with the addition of the three HDD's appears to the system as unallocated space. After the system reboots, you must allocate the unallocated space. For Windows XP, the only option through the operating system is to create and format a separate volume. Windows Vista and Windows 7 contain additional capabilities that allow you to create a single RAID 5 volume. Refer to Allocating unallocated HDD space for an HP image on page 30 for further instructions.

Allocating unallocated HDD space for an HP image

If you want one continuous C: partition for RAID 0 and RAID 5, you must allocate the unallocated space after the system reboots for the final time. You can create an additional partition, or you can extend the (C:) partition. In order to extend the (C:) partition, you must move the Extensible Firmware Interface (EFI) and Recovery partitions using the following procedure. The EFI partition stores QuickLook, system diagnostics, and BIOS Flash Recovery files. The Recovery partition contains files that allow you to restore the computer to the factory image.

NOTE: If the functionality of the EFI and Recovery partitions is not required, these partitions can be deleted.

In Windows XP:

1. After the system reboots, select **Start**, right-click **My Computer**, and then click **Manage** from the drop-down menu.

2. In the left pane under Storage, click **Disk Management**. The Disk Management window displays the unallocated space and two partitions: (C:) and HP_TOOLS.

3. Right-click the **Unallocated** capacity, and then select **New Partition** from the drop-down menu. The New Partition Wizard opens.

4. Click **Next**.

5. Select **Primary Partition**, and then click **Next**.

   The partition size defaults to the maximum.

6. Click **Next**.

7. Assign a drive letter, and then click **Next**.

8. Select the **NTFS** format, enter the volume name, and then click **Next**.

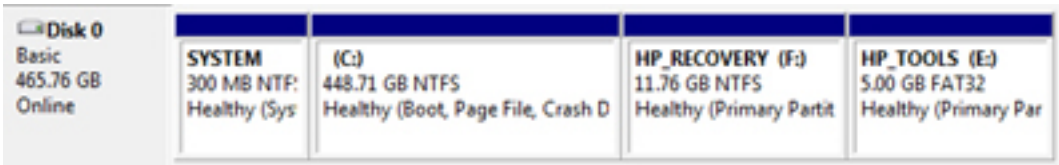
9. Review your selections, and then click **Finish** to complete the formatting.

In Windows Vista and Windows 7:

1. Select **Start**, right-click **Computer**, and then click **Manage** from the drop-down menu. The Computer Management window displays.

2. In the left pane under Storage, click **Disk Management**. The Disk Management window displays the existing partitions and unallocated space—(C:), HP_TOOLS, and HP_RECOVERY. Write down the size displayed for the HP_RECOVERY partition (for example, 11.76GB), and retain this information for an upcoming step.

NOTE: The drive letters shown in Disk Management may vary depending on your system configuration.



3. Connect an external USB drive with at least 40 GB of free capacity to a USB port on the computer.
4. Open Windows Explorer, and then select the primary drive **(C:)**.
5. Select **Organize > Folder and Search Options**.
6. Click the **View** tab.
7. Under **Hidden files and folders**, select the radio button next to **Show hidden files and folders**.
8. Uncheck the box next to **Hide Protected Operating System Files**, and then click **OK**.
9. Select the **HP_RECOVERY** partition in the left pane, and then copy its contents (\boot, \Recovery, \system.save, bootmgr, and HP_WINRE) to the external USB drive. If the Destination Folder Access Denied window displays, click **Continue** to copy the file. If the User Account Control window displays, click **Continue**.
10. Select the **HP_TOOLS** partition in the left pane, and then copy its contents (\Hewlett-Packard, HP_Tools) to the USB drive.
11. Return to the Disk Management window and select the **HP_RECOVERY** partition. Next, click the **Delete** icon in the menu bar. Repeat this procedure for the HP_TOOLS partition. The amount of space to restore HP_RECOVERY and HP_TOOLS must be calculated.

    To calculate the amount of space to restore HP_RECOVERY and HP_TOOLS, and to convert the value of the HP_RECOVERY partition size from gigabytes (GB) to megabytes (MB):

    a. Multiply the HP_RECOVERY partition size (see step 2 above) by 1024, and then round up the result. For example, multiply a result of 11.76 GB by 1024, and then round the result (12042.24 MB) to 12043 MB.

    b. Multiply the HP_TOOLS size by 1024, and then round up the result. For example, if the size of HP_TOOLS is 5GB, the result is 5120 MB.

    c. Calculate the hard drive's metadata space (for example, 6 MB) at the end of the HDD, and then add these three values together (ex 12043MB + 5120MB + 6MB = 17169MB). The result shows the space that must be reserved for restoring the HP directories.
12. Right-click the **(C:)** drive, and then click **Extend Volume** from the drop-down menu. The Extend Volume Wizard opens.
13. Click **Next**.

14. The amount of unallocated capacity (in MB) available to extend the (C:) drive is displayed next to **Select the amount of space in MB** (for example, 494098 MB). Subtract the value for the reserved space to restore the HP directories (calculated above) from the amount of unallocated capacity (in MB) available to extend the (C:) drive. For example, 494098 MB – 17169 MB = 476929 MB. Replace the **Select the amount of space in MB** with the calculated capacity (for example, 476929 MB), or press the down arrow until the calculated number is displayed.

15. Click **Next**, and then click **Finish**. The new RAID volume capacity and the new unallocated capacity are displayed in the Disk Management window.

16. Create the HP_RECOVERY partition as follows:

    a. Right-click the **Unallocated** capacity, and then click **New Simple Volume** from the drop-down menu. The New Simple Volume Wizard opens.

    b. Click **Next**.

    c. Enter the rounded value from step 11a above in the space provided, and then click **Next**.

    d. Select the drive letter **(E:)**, and then click **Next**.

    e. Select **NTFS** as the File System. To the right of Volume label, enter the name HP_RECOVERY.

    f. Click **Next**, and then click **Finish**.

17. The following steps are needed to create the HP_TOOLS partition. The extra steps are required because the HP_TOOLS partition must be created as a primary partition. If Disk Management is used, the partition is created as a logical drive.

    a. Open a command line prompt with administrator privileges (**Start > All Programs > Accessories**).

    b. Right-click Command Prompt, select **Run as Administrator**, and then type the following commands:

    Diskpart

    Select disk 0

    Create part primary size=5120

    Format fs=fat32 label=”HP_TOOLS” quick

    Assign

    Exit

18. Restart the computer.

19. In Windows Explorer, copy the contents of the HP_TOOLS and HP_RECOVERY partitions from the USB drive to the respective partitions.

20. In order for the HP Recovery functionality to work correctly (f11 during POST), the Boot Configuration Data (BCD) needs to be updated. The following commands must be run in

Administrator mode. It is recommended that a batch file (*.bat) be created with these commands and run, rather than typing them in individually.

NOTE: The commands assume that the HP_RECOVERY partition is drive (E:). If it is different, replace E: with the correct drive letter.

BCDEDIT.EXE -store E:\Boot\BCD -create {ramdiskoptions} -d "Ramdisk Options"

BCDEDIT.EXE -store E:\Boot\BCD -set {ramdiskoptions} ramdisksdidevice partition=E:

BCDEDIT.EXE -store E:\Boot\BCD -set {ramdiskoptions} ramdisksdipath \boot\boot.sdi

BCDEDIT.EXE -store E:\Boot\BCD -create {572bcd55-ffa7-11d9-aae0-0007e994107d} -d "HP Recovery Environment" -application OSLOADER

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} device ramdisk=[E:]\Recovery\WindowsRE\winre.wim,{ramdiskoptions}

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} path \windows\system32\boot\winload.exe

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} osdevice ramdisk=[E:]\Recovery\WindowsRE\winre.wim,{ramdiskoptions}

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} systemroot \windows

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} winpe yes

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} detecthal yes

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} nx optin

BCDEDIT.EXE -store E:\Boot\BCD -set {572bcd55-ffa7-11d9-aae0-0007e994107d} custom: 46000010 yes

BCDEDIT.EXE -store E:\Boot\BCD -create {bootmgr} /d "Windows Boot Manager"

BCDEDIT.EXE -store E:\Boot\BCD -set {bootmgr} device boot

BCDEDIT.EXE -store E:\Boot\BCD -set {bootmgr} displayorder {default}

BCDEDIT.EXE -store E:\Boot\BCD -set {bootmgr} default {572bcd55-ffa7-11d9-aae0-0007e994107d}

21. After the batch file is created, right-click the file in Windows Explorer, and then select **Run as Administrator** in order to execute the batch file.

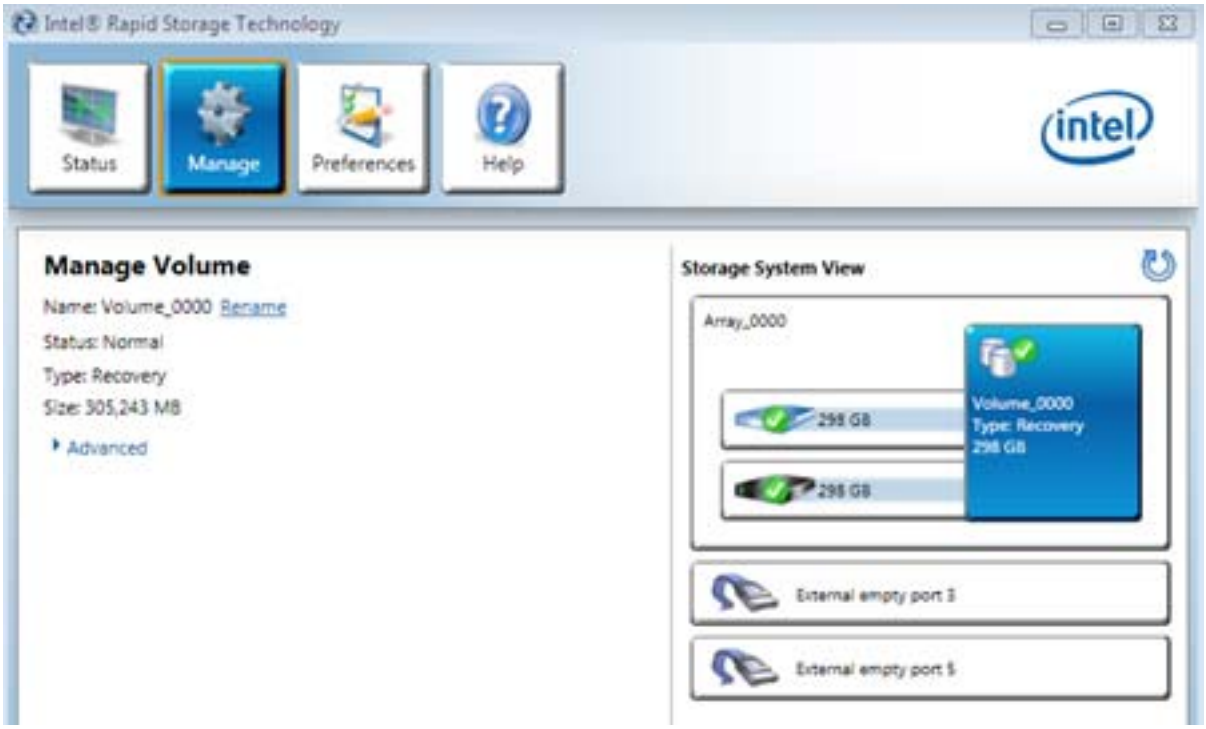
22. Restart the computer.

Using Intel Rapid Storage Technology Console Recovery features

Modifying the volume update policy

When using Recovery, you can select how often the recovery HDD is updated: continuously or on-request. Continuous Updates is the default update policy (see Mirror update policies on page 11). The steps to change the update policy to on-request are as follows:

1. Click **Manage**, and click the Recovery Volume to select it.



2. Click the **Advanced** link in the left pane.

3. Update mode displays the current setting. To change the current setting, click the **Change Mode** link, and then click **Yes**. When using the on-request update policy, you can manually update the recovery volume by selecting the **Update Data** link.

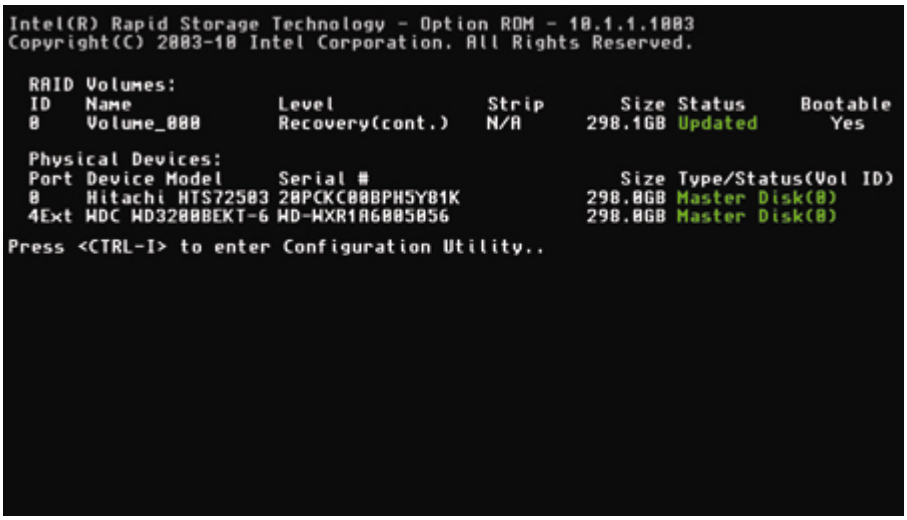
4. You can restore the continuous update policy at any time by selecting the **Change Mode** link, and then clicking **Yes**.

6 Resetting RAID drives to non-RAID

You can reset a RAID 1 or Recovery volume to two non-RAID drives using the following instructions to access the Intel Option ROM and reset both drives to non-RAID status. You must also reset both drives to non-RAID if you need to move the RAID recovery drive from the computer's upgrade bay to the docking station's bay.

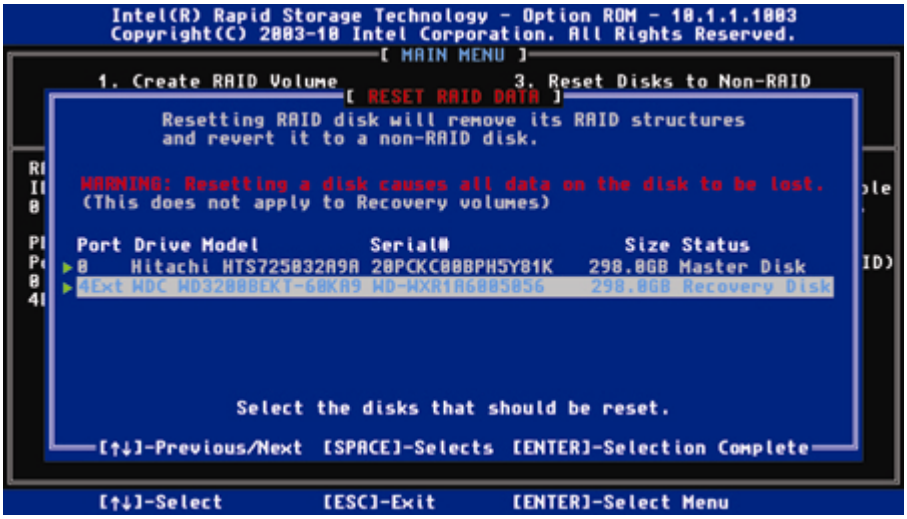
NOTE: A RAID 0 or RAID 5 volume cannot be migrated to a RAID 1 volume or to a non-RAID primary HDD because the size of the RAID 0 or RAID 5 volume may be greater than the capacity of the primary HDD. If you wish to return the primary HDD in a RAID 0 or RAID 5 volume to non-RAID status, you must first back up all data to an external drive with sufficient capacity. Next, follow the steps below to reset the RAID 0 or RAID 5 drives to non-RAID. After you complete the procedure, you must reinstall the operating system on the primary drive.

1. Power on or restart the computer. When the Option ROM window displays, press ctrl+I to enter the configuration utility.



2. In the Main Menu, use the up or down arrow key to select **3. Reset Disks to Non-RAID**, and then press enter. The Reset RAID Data window displays.

3. Press the space bar to select the first drive, and then press the down arrow key and the space bar to select the second drive.



4. Press enter, and then press Y to confirm the selection.
5. Use the down arrow key to select **Exit**, and then press enter and Y to boot the system.

7 Frequently asked questions

Can more than one RAID volume be installed on a computer?

No, there can only be one RAID volume on a computer.

Is RAID supported to allow both RAID 0 and RAID 1 on a single RAID volume?

No.

Can the computer be undocked if the recovery HDD is in the docking station SATA-swappable bay?

Yes. If the “Continuous update” policy is selected, data is automatically copied to the docking station's recovery drive when the computer is re-docked. If the “Update on request” policy is selected, you must follow the normal procedure to copy data to the recovery HDD when the computer is re-docked.

What are the maximum number of HDDs that can be connected to the system during boot when the storage controller is in RAID mode (f10 Computer Setup)?

This limitation does not apply when the storage controller is in AHCI mode. Once the storage controller is changed to RAID mode, only 3 HDDs can be connected to the unit during boot up. After the notebook is booted up, additional HDDs can be connected. This does not apply to attached USB HDDs.

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